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Can Voluntary Adoption of Agricultural Practices Achieve the Hypoxic Zone Reduction Goals?

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THE PRESENCE of a "dead zone" in the Gulf of Mexico caused by nutrients (nitrogen and phosphorus) coming from upstream watersheds continues to recur annually. As part of the 2008 action plan promulgated by the Hypoxia Task Force (http://water.epa.gov/type/watersheds/named/msbasin/index.cfm) to address the problem, each state with major nutrient contributions to the Gulf was tasked with developing and implementing a nutrient reduction strategy. Most of the 12 states included have begun or completed their plans. A common theme among all states is the focus on voluntary adoption of the practices identified rather than a regulatory strategy.

In addition to identifying the conservation practices that will be most cost effective in their region, some state plans are also identifying the coverage of the identified practices that will be necessary to achieve the target reductions in nitrogen and phosphorus. These "scenarios" are extremely helpful in understanding the extent of the change needed on the landscape to achieve the goals of the Hypoxia Task Force. For example, as the Iowa Nutrient Reduction Strategy indicates, to achieve the targeted nitrogen and phosphorous reduction goals, over 90% of the 21 million acres of row crop agricultural land will need to be treated with practices ranging from improved nutrient management, cover crops, bioreactors and/or wetland installation or other equally effective approaches. Can a voluntary approach lead to this extensive adoption of these practices?

To consider this question, imagine a situation where there is no cost share or compensation for farmers/landowners to adopt new practices. Even in this case, there are a number of possible benefits that these practices might generate to induce adoption. Like most businesses, farmers compete in a competitive and uncertain environment. Any conservation actions that improve profitability without increasing risk will be appealing. A practice that either increases yield, lowers the cost of production, or both fits this category. A great example is the use of reduced or no till, which, under the right circumstances, can lower input costs and increase yield over the long run. Indeed, we have seen farmers in many locations adopt this practice with no financial compensation. A second category of on-farm benefits can come from practices that reduce risk or save time during particularly busy portions of the season. An example of the former can be precision application of nutrients. A third type of benefit a farmer might receive from conservation actions is the enjoyment that comes from nearby wildlife habitat, production of windbreaks, aesthetic appreciation, or other environmental benefit. Buffers, wetlands, and perennial grasses provide these benefits. Finally, farmers may receive benefits in the form of satisfaction from improving their environmental performance.

Of course, in the situation where there is no cost share or compensation for the adoption of these practices, there will typically be some costs of adoption. First are costs that directly come from the bottom line, reducing profit. Many conservation practices, particularly structural practices, have significant installation and maintenance costs associated with them. In addition to terraces, wetland restoration, and buffers, new practices such as bioreactors fall into this category. The second way in which the bottom line can be directly impacted is through lower yields. For example, it appears that cover crops may sometimes reduce yield, and any practices that take land out of production, such as buffers, will require forgoing production on part of the land. A third type of costs that farmers can face with conservation practices is increased risk or management time. For example, reduced tillage in locations that are cool or wet can increase risk, and

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precision agriculture generally requires more time for proper management. Finally, there may be practices that are aesthetically unappealing to a farmer, increase pest pressure or have other undesirable side effects. All of these components can be considered costs of a practice.

Having considered the range of on-farm costs and benefits of conservation practices, let's return to the question of whether voluntary adoption (in the absence of any financial compensation) is likely to result in the adoption of practices needed to achieve the goals of the Hypoxia Task Force. If farmers can generally be expected to voluntarily adopt the practices for which the benefits they receive exceed the costs they incur, which practices pass this "benefit-cost" test?

Iowa Strategy

In the Iowa Strategy, three scenarios are identified that would achieve the goals of the Hypoxia Task Force. The primary practices in these scenarios include conservation tillage, reduced nitrogen application rates, increased use of side dressing, cover crops, wetlands, buffers, controlled drainage, and bioreactors. Of these, conservation tillage and alterations in nitrogen application rates and timing have the greatest potential to increase profitability at the farm level. Numerous studies suggest that in the right locations, conservation tillage can lower cost and increase average yields, and changes in nitrogen application rates and timing can lower cost. However these practices alone are likely to achieve only a modest (less than 9%) reduction in nutrients, far short of the 40% reduction goal for agriculture. Will voluntary adoption of other practices make up the difference?

Because cover crops are relatively new to the Midwest, we are still learning about the on-farm benefits and costs. On-farm benefits could include improved soil health and therefore improved yields in the long run. However, this must be balanced against direct annual costs of $30 or more per acre. While the jury is still out, yield increases will need to be substantial and sustained for benefits to outweigh the costs, at least with current prices and technology.

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Wetlands are a relatively expensive option as they require taking land out of production as well as restoring the area. They do, however, provide a suite of ecosystem services outside of water quality improvement, some of which will accrue to farmers and landowners. However, many of these values accrue to off-site beneficiaries and the high costs of wetlands make voluntary large scale adoption unlikely. Buffers could be considered to fall into this same category.

Finally, bioreactors and a variety of forms of drainage management are being developed that are particularly effective at controlling the loss of nitrogen. In addition to being expensive, the primary benefits of these practices are to improve water quality downstream; hence there is little hope that the on-farm benefits will exceed the costs of adoption.

If the above characterization of costs and benefits to farmers/landowners from the needed conservation practices is roughly correct, then purely voluntary adoption of conservation practices seem unlikely to achieve the goals set forth by the Hypoxia Task Force. Of course, one option is for cost share or direct compensation of the costs to be covered by government or NGOs. The United States has a long history of providing financial assistance to farmers and landowners for conservation via federal and state programs. However, the costs of such an approach are striking: for Iowa alone the Nutrient Reduction Strategy reports that these costs could be from $80 million to $1.4 billion annually. It seems unrealistic to think that funding amounts of this size will become available.

Incentives

Are there other options? First, as improvements are made in cover crop varieties and more experience with them is gained, there may be opportunities to lower the costs and benefits towards a higher adoption rate. Second, there may be some locations in the state where limited water quality trading or other innovative approaches could make some progress, but such opportunities are likely to be limited in scope. Finally, new markets and opportunities for alternative crops could be game changers. For example, if perennial crops become commercially viable as biofuel feedstocks, rapid and extensive adoption could follow—their perennial nature makes these crops very effective at nutrient and sediment retention. Likewise, if new markets are developed for cover crop varieties, this could change the on-farm benefit cost calculus quickly in favor of expansive adoption. ■